UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

R-10

#1990

Rush

REPLY TO: 5230 Forest Insect and Disease Evaluation 6/25/75

SUBJECT: Sampling point location

TO: Insect and Disease Management Personnel

In the past few weeks, all four of us have been involved in the marking of sampling points or study areas that we expect to see revisited in future weeks, months, or years. The value of the data we collect now will depend on how well we can locate the sampling points in the future.

The three items enclosed may provide some ideas that will help us reference field locations adequately without our wasting a lot of time doing so.

Bruce

BRUCE H. BAKER
Protection Specialist

Enclosure

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PROCEDURES FOR FIELD SAMPLE MEASUREMENTS

Reaching the Ground Sample Location in the Field

Field Travel

Field crews will work from the field location itinerary compiled by the field supervisor. The field supervisor will reserve and coordinate all vehicles of travel.

The field crew must find, on the ground, the exact point pinpricked on the photo. They will be furnished with maps, aerial photos, and a ground location list. This list will contain the location number, photo number, photo interpretation classification, and recommended means of travel to the location. Locations are marked and numbered on maps, and pinpricked and circled on their respective aerial photos. The location number is marked on the back of the photo in a stamped location information format (see fig. 2). The maps and photos are used in traveling to the general vicinity of the plot. The aerial photos are used to find the ground location as pricked on the photo. The crew will record the means of travel to the location vicinity in item 73 on the sample record sheet. Logical reference landmarks should be recorded also.

Location No._____ Location Elev._____

Photo Scale 1:_____ @ _____Ft. Base Line Az._____

R.P. to Plot Az._____ Distance_____

R.P. Species _____ D.B.H. _____

Photo Call _____ Ground Call _____

Figure 2.--INFORMATION FORMAT for back of photos.

Plot No. _____ Plot Elevation _____

Base Line Az. _____ Scale _____

Az. _____Dist._____ Sp._____ DBH_____

Photo Call _____ Gd. Call _____

Base Line Azimuth and Photo Scale

Usually, the ground location cannot [illegible] mined in the field. The field crew [illegible] object which they can find on both [illegible] photo and measure from there to the [illegible] accurately measure to the location [illegible] (1) photo scale to determine dist[illegible] compass azimuth to determine direc[illegible] tion is obtained from one of two me[illegible]

The ground-photo base line method

1. Select two trees or other [illegible] sight of each other, which are [illegible] on the aerial photo and on the [illegible] points should be at least .75 [illegible] photo and at the same relative [illegible] Avoid using railroads or power [illegible] influence compass readings.

2. Carefully tape the horizon[illegible] between these points and recor[illegible] format on the back of the phot[illegible]

3. Pinprick these two points [illegible] possible, use the photo which has [illegible] location on it.

4. Orient the scale-protractor [illegible] points on the photo. By trial [illegible] the photo scale which best fits [illegible] on the ground. Record, in the [illegible] the photo, the scale which was [illegible]

5. Draw a line through the two [illegible] Place an arrow at one end of [illegible] the direction of the azimuth.

6. Determine the magnetic com[illegible] line between the two intervis[illegible] this azimuth in the format on [illegible]

Base Line Azimuth and Photo Scale (continued)

The map-photo base line method

1. Measure the distance in inches between two points on a reliable map.

2. Measure the distance in inches between these same two points on the aerial photo.

3. Note the map scale reciprocal.

4. Determine the photo scale reciprocal using the following formula:

$$\text{Photo scale reciprocal} = \frac{(\text{Map distance}) \times (\text{Map scale reciprocal})}{\text{Photo distance}}$$

5. Draw this measured line on the map, extending it to intercept a meridian or latitudinal line on the map.

6. Using a compass protractor, oriented to the map meridian line, determine the true azimuth of the drawn line. Subtract the map declination to get the magnetic azimuth.

7. Draw this same line on the photos with an arrow at one end to show azimuth direction. Record the magnetic azimuth and the photo scale in the format on the back of the photo.

Reference Point (RP)

The field crew must find a reference point (RP) which will serve as a starting point and for remeasurement crews. Much thought and care must go into choosing and referencing this point.

1. Locate an object on the ground, near the ground location, that can be readily identified on the photo and on the ground. This object can be a tree, rock, building, or some other object. The more permanent the object, the greater its usefulness as a reference point. A tree is usually used for this purpose, but it should be a tree that will live for at least 10 years.

2. Using a stereoscope, locate and pinprick this RP on the photo. On the back of the photo, circle the pinprick and label it with the letters "RP." In addition, identify the RP as a tree, rock, etc. If the RP is a tree, note the species and diameter in the format on the back of photo.

Reference Point (RP) (continued)

3. Describe the reference point on the Location Record sheet in item 74. Include a description of how to reach the RP and any additional notes which will help in relocating it, such as location relative to outstanding physiographic features. Map sketches are very helpful in relocating the RP.

4. The RP tree is blazed and referenced as illustrated in figure 3. However, if the tree is close enough to the ground location center that it may be tallied on the location, no blazes should be made on the tree, and the reference plate should be at least 5-1/2 feet above the ground.

Photo Azimuth and Distance--RP to Location

With the reference point located and marked, and having established a photo baseline, determine the magnetic azimuth and distance to the ground location in the following manner:

1. With a needle point or sharp pencil, lightly scribe a line on the photo from the RP pinprick to the location center pinprick. Extend this line until it intersects the scribed base line (or an extension of the base line).

2. Orient the photo scale protractor over this intersection and read the azimuth from the RP to the location center to the nearest degree. Record this azimuth in the information format on the back of the photo and in item 74 of the Location Record sheet.

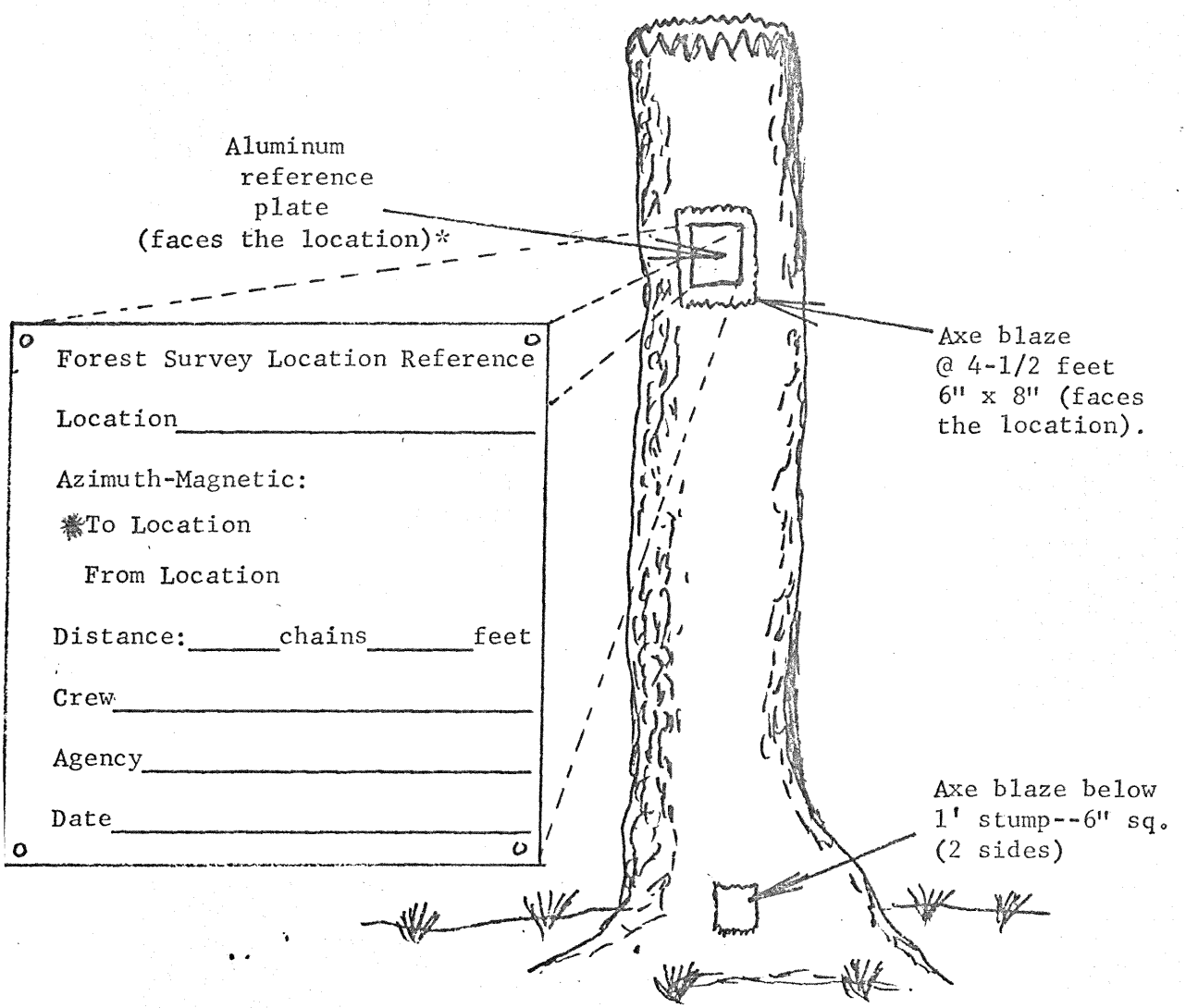
3. Using the proper scale[4/] on the photo-scale protractor, measure the photo distance, to the nearest one-quarter chain, from the RP to the location center. Record this information in the format on the back of the photo and in item 74 of the Location Record sheet.

4. Attach an aluminum reference plate to the RP (at d.b.h.) facing the ground location. Mark the plate as illustrated in figure 3. One or two more inverted dataless plates should be spaced around the bole to make the tree easier to see in the reinventories.

4/ If the RP is higher or lower in elevation than the base line, adjust the scale according to the table on page 146 of the appendix.

Figure 3

MARKING THE PLOT REFERENCE TREE (R.P. tree)



*One or more inverted dataless plates should be spaced around the bole.

Proceeding from RP to Location

Chain from the RP to the pricked ground location, using the azimuth and distance determined. Bark-blaze trees at 2-chain intervals with two blazes, vertically aligned, chest high, and facing the RP. Also place one bark-blaze, chest high, on this tree facing the location center. At intermittent 1-chain intervals, blaze a tree with a single chest-high bark-blaze facing the RP. Avoid blazing trees which might be tallied on the location to prevent damaging potential growth sample trees. This will mean suspending tree blazing for the last 3 chains of line.

Establishing the Location Center

Upon arrival at the end of the prescribed distance, check the photos to see if you are at the pinpricked location. If your ground position is at the point pinpricked on the photo, set a 1-1/2 - foot stake.

If your ground location is clearly not the point pinpricked on the photo, and the correct location can be determined visually, move the stake to the correct location. Record the azimuth and distance from the first setting to the final setting. This should be entered in item 83 of the Location Record sheet and on the back of the photo. This final setting becomes the sample location center and is sample point number 1 of the grid of 10. The other nine sample points will be marked with an 18-inch plastic pin.

Before establishing and witnessing the ground location, check the land-use classification in which point number 1 falls. The minimum area for classification of land class, or subclasses of forest land, is 1 acre. Roadside, streamside, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas will be classified as forest land if they are less than 120 feet wide. Using the land class definitions and criteria from the glossary, the field crew must decide if point 1 falls on commercial forest land, noncommercial forest land, or nonforest land.

Point 1 on noncommercial or nonforest land

If sample point number 1 falls on 1 acre or more of nonforest land; or in a willow, alder, brush, or other noncommercial land type over 1 acre in size; complete only items 1 through 12 (ignore 10-12 for nonforest), 56, and items 71 through 74, 77, 78, and 80 on the Location Record Sheet. For aids in determining the commercialability of the acre, see appendix pages 111 and 119. Use the cumulative tally summary shown on page 111 to determine the gross volume of the stand. Then, reducing this volume to net board feet, by applying Kimmey defect reduction of the table on page 119, a decision can be made regarding

Establishing the Location Center (continued)

the commercialability of the acre. If the acre will not now, or in the foreseeable future, meet the definition of a commercial stand as specified in the glossary, the location will be classified as noncommercial.

Point 1 on noncommercial or nonforest land (continued)

If there is evidence of prior occupancy of a commercial stand, or if a minor component of the present stand is a commercial species which may eventually produce a commercial stand, the location will be taken as a commercial location. If there is any doubt that the acre is noncommercial forest land, the location will be taken as a commercial location. In these instances, notes will be taken in the field describing the physiographic features of the area (i.e., steep slopes, broken terrain, vegetative types) and other factors which the field crew feel should be considered in making the final decision. The location will then be discussed with the field supervisor in the office and the final decision will be his.

Point 1 on commercial land

If sample point number 1 falls on land that qualifies as commercial forest land, complete the establishment of the location and complete the measurements of sample data.

Point center in tree trunk

If point number 1 falls within a tree trunk, shift the point location back along the line of approach for a distance of 2 feet from the edge of the tree trunk. Mark this point with a stake, and witness the stake. If sample points 2 through 10 fall within a tree trunk, shift the point location 2 feet back along the line of approach from the edge of the tree trunk. Mark these points with a pin. When chaining on to the next point from points 2 through 9, measure from the correct position within the tree trunk, and not from the relocated pin.

Witness Tree

Each ground location is carefully referenced in the field so that it can be relocated and remeasured on subsequent reinventories. After determining from the field check that the location is to be established and data collected, reference sample point number 1 with two witness trees. They should preferably be (a) close to the point center, (b) not likely to die or be cut within 10 years, (c) a species easily located in the stand, (d) 5 inches d.b.h., or at least 2 inches in diameter if no trees 5 inches or larger are available, and (e) the trees should subtend an interior angle of

Witness Tree (continued)

from 45° to 135° with the point center. Mark these trees and make the necessary measurements as illustrated in figure 4.

For each witness tree, record in item 74 on the Location Record Sheet: (a) species, (b) d.b.h. to the nearest 1/10 inch, (c) azimuth from the stake to the center of the tree, and (d) the level distance, to the nearest 1/10 foot, from the center of the tree at d.b.h. to the stake.

Place an aluminum tag just below d.b.h. and facing the location center.

Locating the Ten Sample Points

Ten-point Sample Cluster

After point 1 has been established and measured, the other nine points must be located, marked with plastic pins, and measured.

The following azimuths and distances will be used to establish the remaining points:

Distance and Azimuth Between Points

Azimuth	Distance	from Point	to Point	
0°	70 feet	1	2	
0°	70 feet	2	3	
120°	70 feet	3	4	
180°	70 feet	4	5	
180°	70 feet	5	6	
300°	70 feet	6	1	(Closure check)
180°	70 feet	1	7	
300°	70 feet	7	8	
0°	70 feet	8	9	
0°	70 feet	9	10	
120°	70 feet	10	2	(Closure check)

This pattern results in 10 equilateral triangles with sides 70 feet in length. (See the 10-point cluster diagram, fig. 1.)

The objective of this grid pattern of sample points is to evenly distribute the points over approximately 1 acre, but keep the points far enough apart to be as independent as possible.

MANUAL OF FIELD INSTRUCTIONS

Substitute Points

If a point falls in an area of noncommercial forest or nonforest land which is less than 1 acre in size or less than 120 feet wide, and bounded by commercial forest land, the point will be tallied as commercial forest land. However, if any of points 2 through 10 fall on noncommercial forest or nonforest land which is more than 1 acre in size and more than 120 feet wide, then a substitute point will be located on commercial forest land.

Establish all points falling in commercial forest land on the regular location grid and assign each point the same number that it would normally take. The substitute point should then be located by starting at zero azimuth from the highest numbered regular commercial forest point and rotating clockwise by 60-degree intervals to locate the first qualifying point which forms an additional equilateral triangle of points. The point at 0° azimuth should be used first when possible. When more than one substitute point is required, continue this rotation by 60-degree intervals selecting in turn other qualifying points forming additional triangles from this point. If necessary, repeat this procedure at the next highest numbered regular commercial points in turn, and finally for each previously selected substitute point in turn.

One substitute point

In the illustration on this page, a substitute for point 10 is located at 10' by rotating 240° around point 9 (the highest numbered regular commercial point) to locate the first possible additional equilateral triangle of points.

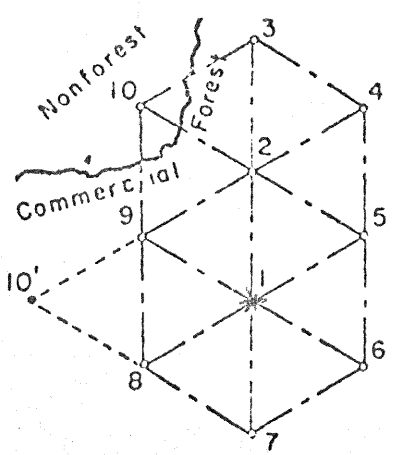
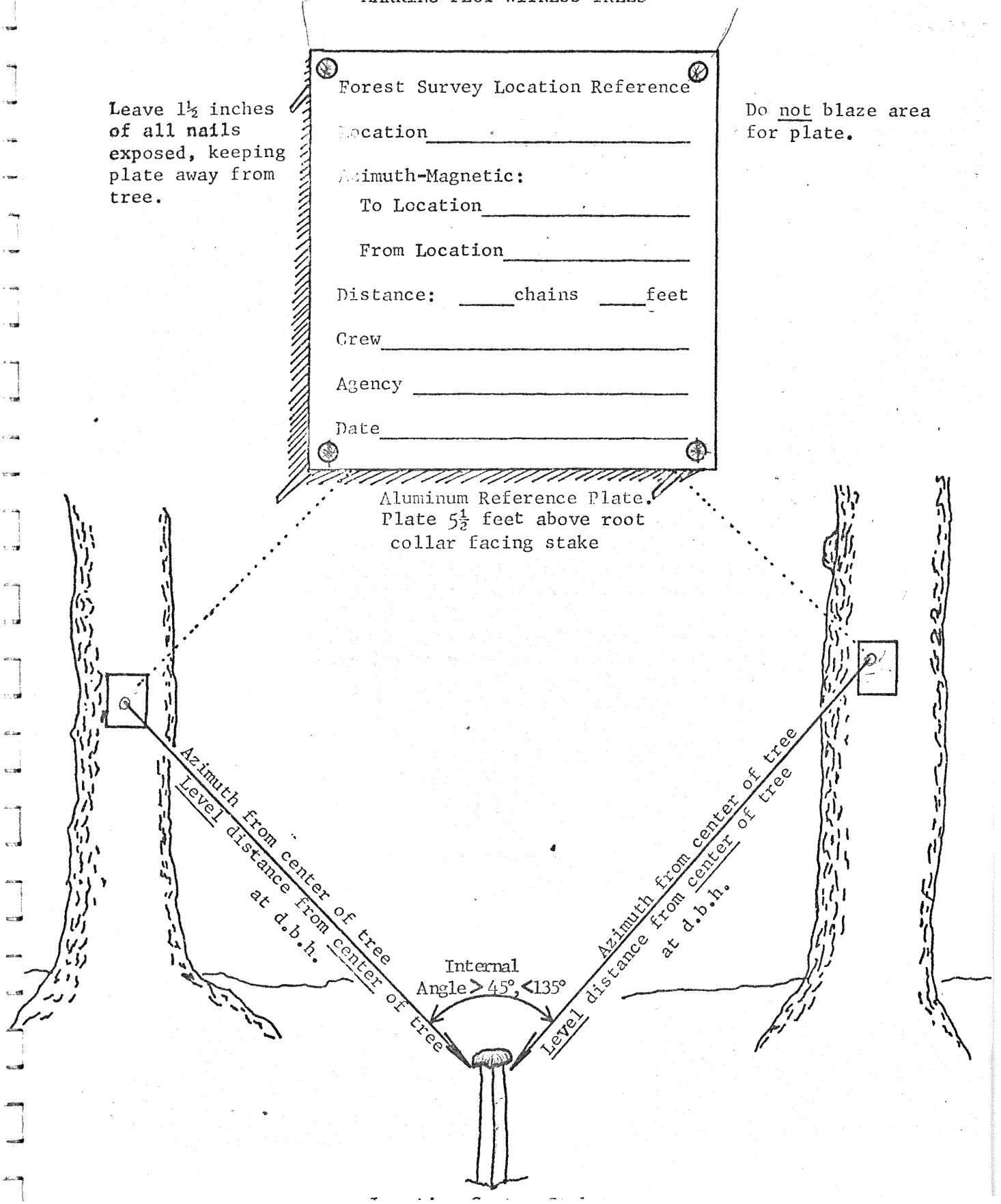


Figure 4

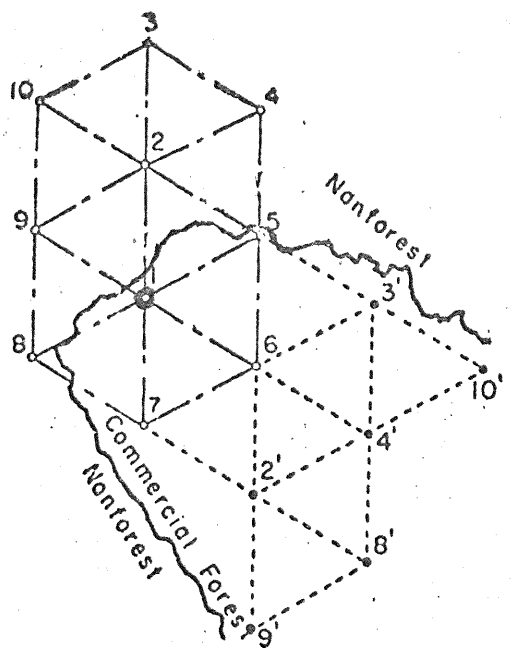
MARKING PLOT WITNESS TREES


Forest Survey Location Reference
Location
Azimuth-Magnetic:
To Location
From Location
Distance: chains feet
Crew
Agency
Date
Leave 1½ inches of all nails exposed, keeping plate away from tree.
Do not blaze area for plate.
Aluminum Reference Plate. Plate 5½ feet above root collar facing stake
Azimuth from center of tree
Level distance from center of tree at d.b.h.
Internal Angle > 45°, < 135°
Azimuth from center of tree
Level distance from center of tree at d.b.h.

Substitute Points (continued)

Six substitute points

In the illustration on this page, substitutes must be located in turn for points 2, 3, 4, 8, 9, and 10. The first substitute point, 2', is located by rotating from zero azimuth around point 7 (the highest numbered regular commercial point) to 120° to form the first possible additional equilateral triangle of points. Further rotation around point 7 yields no more qualifying substitute points; thus, the rotation procedure is repeated from point 6 (the next highest numbered regular commercial point). This yields points 3' and 4'. Rotation around the next highest numbered regular commercial point, 5, yields no additional substitutes. Thus, rotation around the first-selected substitute point, 2', is used to select two more substitutes, 8' and 9'. Rotation around the second-selected substitute point, 3', must be used to locate the last required substitute, point 10'.



Where substitute points are selected, show their location on the Location Record sheet in the diagram, item 82. Also show a number with a prime superscript for each substitute point.

MANUAL OF FIELD INSTRUCTIONS

Points Falling Too Close to Land Type Boundaries

If any of points 2 through 10 fall in commercial forest land, but are so near a land-type boundary (next to noncommercial forest or nonforest land over 1 acre in size and more than 120 feet wide) that the limiting distance of the average diameter for the five largest trees for the acre projects across this boundary, then the point will be relocated using the standard substitution pattern. Points 3 and 9 of the illustration on page 20 should be checked to see if they should be substituted. Points 5, 7, 3', 9', and 10' of the illustration on page 21 should likewise be checked to see if they should be moved (substituted). Point 1 will never be moved.

The limiting distance of the average diameter of the five largest trees is determined as follows:

1. Do not tally any of the points which are in the critical zone (where the limiting distance of the five largest trees might extend into another land type more than 1 acre in size).

2. Complete the tally of the points which are not in the critical zone--i.e., points 6, 2', 4', and 8' in the illustration on page 21.

3. Using the five largest trees tallied at the points in the noncritical zone, sum these basal areas. A table of basal areas by diameter class is found on page 113 of the appendix.

4. Divide the sum of the basal areas by 5 to determine the average basal area. From the table on page 113, read the diameter associated with this average basal area.

5. Determine the limiting distance of this average diameter by multiplying the average diameter by a factor of 1.1. This is the average limiting distance of the five largest trees.

6. Return to each of the points in the critical zone, and radiate the average limiting distance from each of these points. If the limiting distance extends into another land type more than 1 acre in size, locate a substitute point, based on the standard pattern. If the average limiting distance does not extend into another land type, tally the point.

Institute of Northern Forestry

Rev. May 1970

FIELD PROCEDURES

FOR THE

COOPERATIVE FOREST INVENTORIES

OF

INTERIOR ALASKA

Determination of Sample Location

Travel to Plot Vicinity

Record the means of travel to the plot vicinity in item 73 on the sample record sheet. Landmarks or other logical starting points should be noted.

Base Line and Photo Scale

Establish a base line to determine direction and photo scale. This may be done either in the office using the map scale/photo distance method, or on the ground using the base line-photo scale protractor method.

1. Map scale/photo distance

   a.) Use 1/63,360 USGS topographic maps.

   b.) Locate two landmarks visible on both the map and photo. These landmarks should be at least 2 inches apart on the photo and within the photo's effective area.

   c.) Measure the distance between the landmarks on both the map and photo using a common measure.

   d.) $\text{Photo SR} = \frac{(\text{Map SR})\ (\text{Map distance})}{\text{Photo distance}}$

   e.) Use a pinprick or pencil to scribe the base line between the two landmarks on the photo front.

   f.) Determine bearing between landmarks on the map. Mark this bearing and scale on the photo back.

Base Line and Photo Scale (continued)

2. Base line - photo scale protractor

   a.) Select two objects at least 600 feet apart, visible on the photo and intervisible on the ground.

   b.) Pinprick the two objects on the photo and draw a line between them.

   c.) Sight between the two points with a compass to determine the azimuth of this line.

   d.) Measure the ground distance between the two objects.

   e.) With an appropriate photo scale protractor select on the photo the scale that best fits the measured ground distance.

   f.) Record the computed bearing, distance, and scale on the photo back.

   g.) Use a pencil or pinprick to scribe the base line between the two objects on the photo front. Place a directional arrow on the line and mark the azimuth.

Reference Point

An enduring, easily identified object should be used as the control reference point. It should be easily recognizable both on the photo and ground. A tree, rock, road intersection, etc. is usually used.

1. Use a stereoscope to locate the RP on the photo, pinprick and describe it on the photo back and on the Sample Record Sheet under item 74.

2. Place a metal "Forest Survey Location Reference" tag on the side of the R.P. facing the logical means of approach. If R.P. is a tree, blaze below the normal stump height.

3. Place a second reference tag on the side of the tree facing toward the plot I.P. On it scribe the plot number and the data obtained in steps 5 and 6.

4. Draw a line between the RP and IP, intersecting the base line.

Azimuth and Distance, RP to IP

5. Orient the protractor over the intersection of the base line/RP-IP line. Turn the protractor to read same azimuth as the base line. Read the RP-IP bearing, record under item 74 on the Sample Record Sheet.

6. Use protractor and the proper scale, measure the distance between the RP and IP. Record this under item 74.

7. Using compass and chain or tape, run the computed azimuth and distance from the reference point to the sample location (IP).

ESTABLISHMENT OF SAMPLE LOCATION

Establishment of Sample Location

Establishing Location Center

Place a pin or stake at the end of the computed course. If a stake, nail a location tag on top.

If the ground location is clearly not the point pinpricked on the photo, and the correct location can be determined on the site, place a second pin at the correct location. Measure the azimuth and distance from the first pin to the second pin and record these items on the back of the sample record under item 81, and remove the first pin. The second pin becomes the sample location center.

Center in Tree Trunk

If the center of the sample location (or any other of the 10 points at a sample location specified under "Ten Point Plot Cluster") falls within a tree trunk, shift the point location back along the approach line a distance of 2 feet from edge of the tree trunk and mark with pin or stake.

Noncommercial and Nonforest Locations

If the location center (of first point) falls on nonforest land or in a noncommercial forest type, of more than 1 acre, complete only items 1-10, 71, 73, 77, 78, 80, and 74 and 75 when applicable of the sample record sheet. However, if there is evidence of prior occupancy of a commercial stand, or the minor component of the present stand is a commercial species which may eventually produce a commercial stand, or question of productivity (item 51) complete plot data will be taken. All other forest types will be considered commercial forest, for field purposes, and complete plot data will be taken. Final land type classification will be made in the office.

When requested by the cooperator, data will also be collected at noncommercial forest locations using the same procedures as for commercial forest land.

See the appendix for definitions of terms.

Commercial Forest Locations

If the sample location center falls on land that qualifies as commercial forest land, complete establishment and measurement of the sample. If there is any question, the plot will be taken and the final land type classification made in the office.

Witness Trees

Reference the sample location center with two witness trees, if possible. They should preferably be (a) close to the axis and spaced approximately at right angles from each other, (b) not likely to die or be cut within 10 years, (c) a species easily located in the stand, and (d) at least 5 inches in diameter at d.b.h. (at least 2 inches in diameter if no trees 5 inches and over are available). For each witness tree record: (a) species, (b) d.b.h. to the nearest 1/10th inch, (c) azimuth from pin to center of tree, and (d) level distance, to the nearest 1/10th foot, from pin to center of tree at d.b.h.

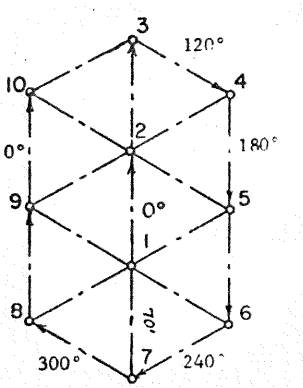
Tag each witness tree with a metal tag just at d.b.h. on the side of the tree facing plot center. Since these trees may be part of the sample, do not blaze as this may affect diameter measurements and/or growth rate. On the back of the Sample Record Sheet make a sketch of the area if it would help in relocation.

Ten-Point Cluster

After the location center has been established, the 10 points will be marked with pins or stakes and measured in the following pattern:

Azimuth and Distance from Point to Point

Azimuth	Distance	From Point	To Point
0°	66 feet	1	2
0°	"	2	3
120°	"	3	4
180°	"	4	5
180°	"	5	6
240°	"	6	7
300°	"	7	8
0°	"	8	9
0°	"	9	10



This pattern results in 10 equilateral triangles with sides 66 feet in length between points (see 10-point cluster diagram).

The objectives of the grid pattern of sample points is to get an even distribution over an acre with points far enough apart to be as independent as possible.

FOREST SURVEY LOCATION REFERENCE

LOCATION BALL POINT PEN

AZIMUTH-MAGNETIC:

TO LOCATION _____

FROM LOCATION _____

DISTANCE: _____ CHAINS _____ FEET

CREW _____

AGENCY _____

DATE _____

NOR 4800-33 4/65